UPTAKE OF ORGANIC VAPORS IN SULFURIC ACID SOLUTIONS

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The uptake of organic vapors, such as methanol, ethanol, and acetone, in liquid sulfuric acid has been investigated under experimental conditions of the acid composition range of 40 to 80 wt % H_2SO_4 and in the temperature range of 193 to 273 K. Laboratory studies were performed using a flow-tube reactor interfaced to an electron-impact ionization mass spectrometer for detection of organic vapors and reaction products. For ethanol vapor, the uptake coefficients (gamma) have been measured and found to vary from 0.018 to 0.065, depending upon the acid composition and temperature. At concentrated acids greater than 70 wt % and dilute solutions (< 70 wt %) colder than 210 K, the gamma values are approaching 0.06. Under other conditions, the gamma values are smaller, indicating the change of uptake mechanism. The adsorption and thermal desorption measurements have been used to distinguish these uptake mechanisms, either solubility or reactive uptake. The results suggest that reactive uptakes are greater than 50 % under all conditions. For dilute acids at warmer temperatures, we also determine the effective Henry's law constants (H*). We will compare the results with the uptake of methyl alcohol and acetone in H_2SO_4 determined previously in our laboratory and elsewhere. The potential implications to the budget of acetone, methanol, and ethanol vapors in the global troposphere will be discussed.